Towards a Virtual Heliospheric Observatory

Data Querying, Processing and Science Applications

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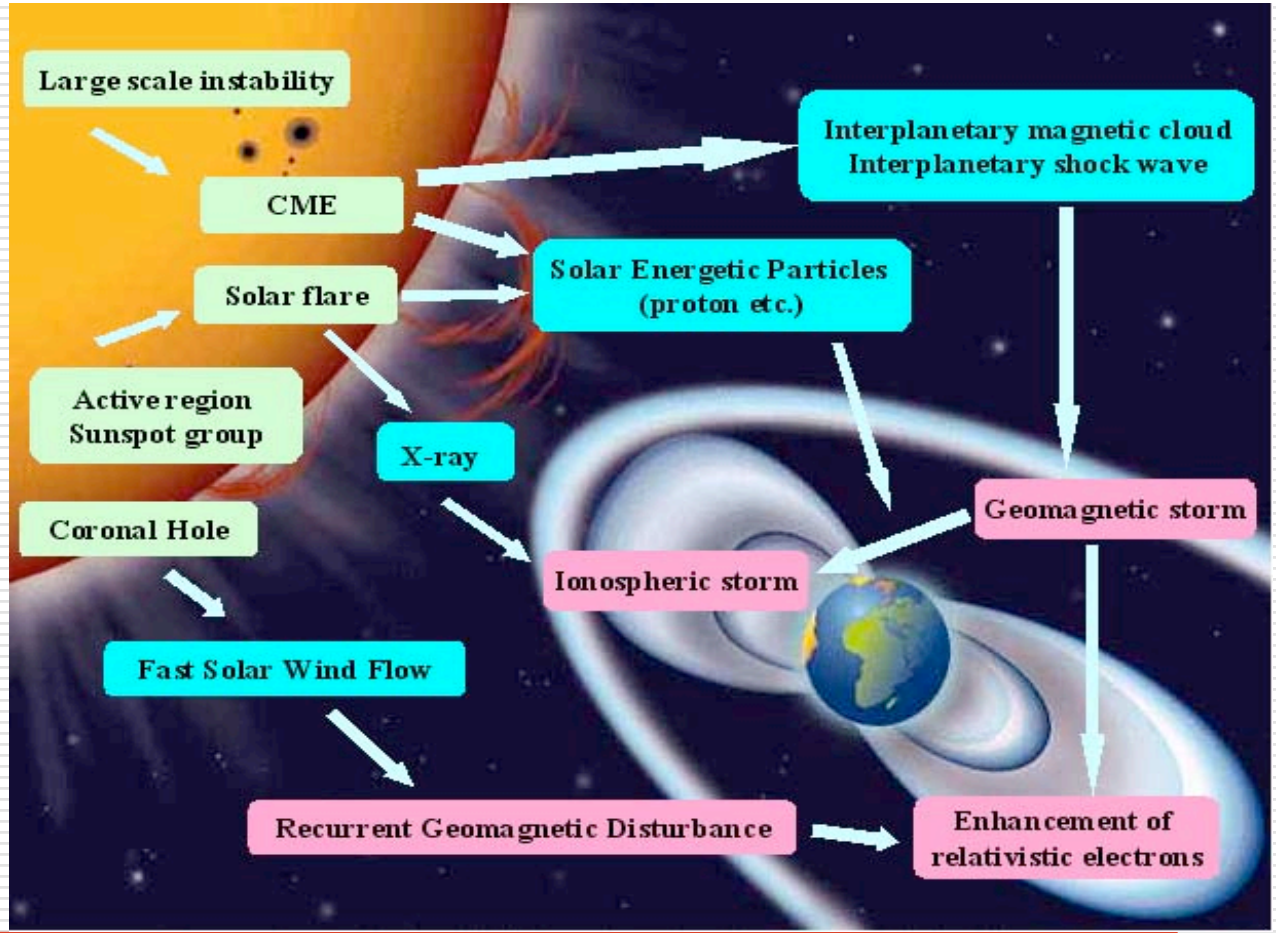
Why Virtual Observatories ?

- Many datasets with large volumes
- Data sites distributed worldwide
- Stored in a variety of formats
- Accessible through a wide variety of interfaces



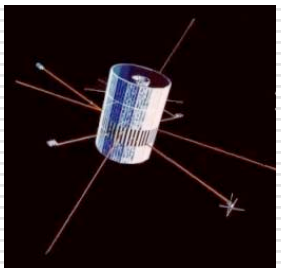
What is the goal of the VHO?

- Simple, unified method of access to all heliospheric data sets and tools.
- Provide community with access to same data products as PI teams use.
- Make data publicly available as quickly and easily as possible.

VHO Data Participants
8 Spacecraft - 13 Data Sets

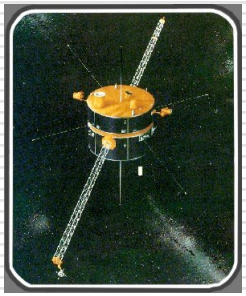
ACE

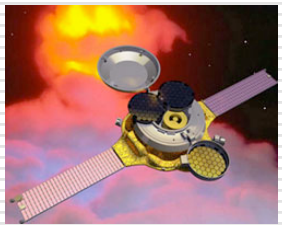
- Magnetometer
- SWEPAM



IMP 8

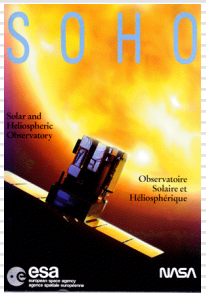
- Magnetometer





Genesis

- Mag. Field Proxy
- 3D Moments

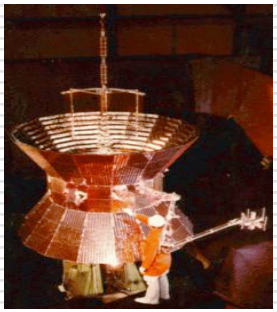


SOHO

- Celias instrument

WIND

- MFI
- SWE
- ELPD
- PLSP



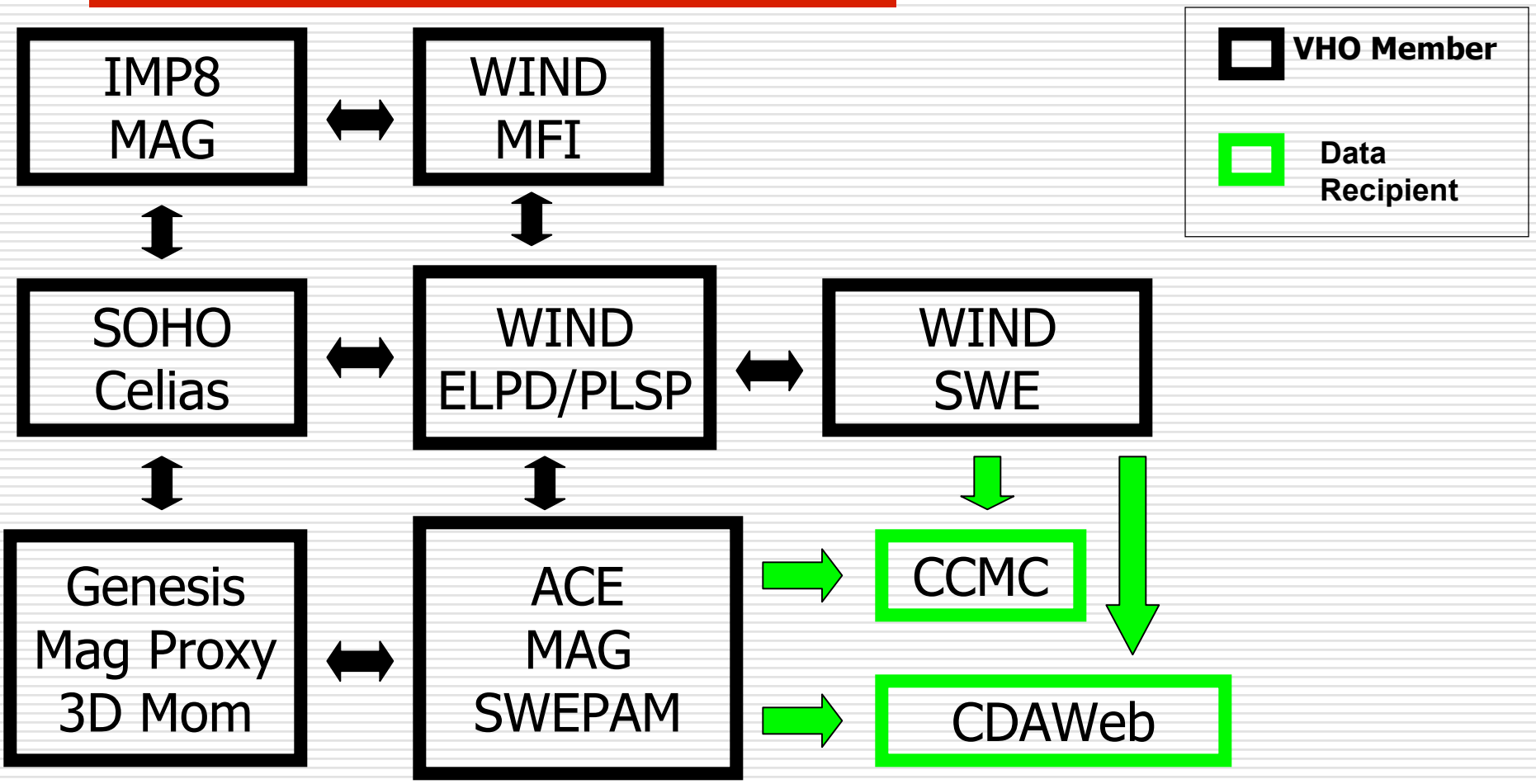
Helios 1 and 2

- Magnetometer
- Plasma instrument

Mars Global Surveyor

-Solar Wind Pressure Proxy

Data Synchronization



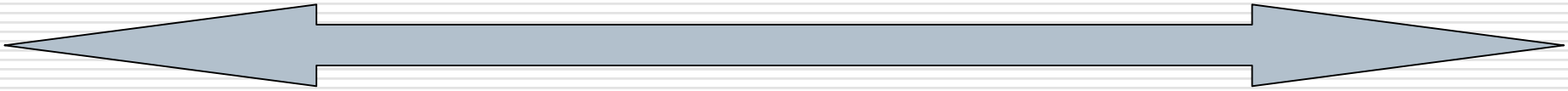
Types of VHO searches

- Offer 5 types of data searches:

1. HGI Latitude/Longitude/Radial Distance
2. Spatial Region, Inner Heliosphere, etc.
3. Bartel Rotation
4. Near Earth - GSM/GSE
5. Near Earth Spatial Region, Bow Shock to ~60 Re

** Data is from solar wind only, magnetospheric data has been removed

Spectrum of Users



Web Based Interface

- Access all types of searches and services from VHO web page

CoSEC

- CoSEC Client software being written to access VHO

Application Programming Interface (API)

- Access VHO from your own software

Services

- Services offer automated data processing:

1. Coordinate Transformations - 12 coordinate systems
2. Ascii Subsetting - merge multiple daily files into one ascii file or subset a few hours from daily files

- CoSEC interface offers ability to use services outside of VHO
- Examples of how to use through API/CoSEC
- Example of how to interface with SSCWeb

Science Example - Magnetic Clouds

- Looking for multiple spacecraft measurements of the same magnetic cloud
- Large structures (~ 1/4 AU) from the Sun and observed in the solar wind and interacting with it.
- Characterized by an enhanced magnetic field intensity, large and smooth magnetic field rotation throughout, and a depressed proton temperature, compared to the ambient plasma

Magnetic Cloud Detection

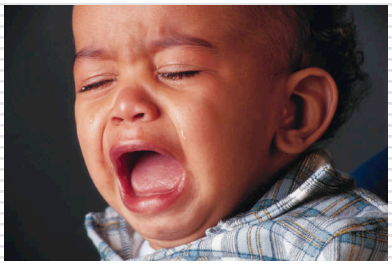
VHO Query

Spacecraft conjunctions

Cloud Detection Program [1]

Results in one afternoon

Manual search for spacecraft conjunctions

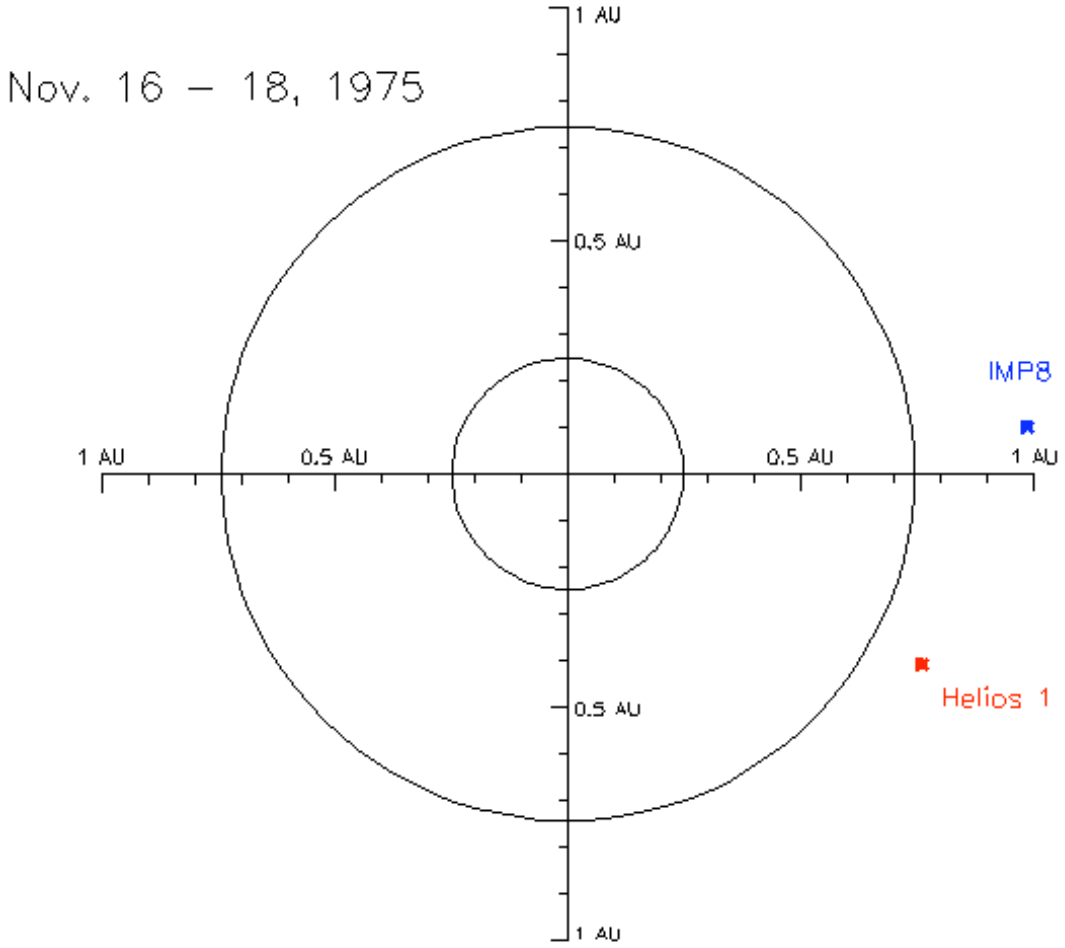


Cloud Detection Program [1]

Weeks/Months

[1] Lepping, R.P., et. al., “Automatic Identification of Magnetic Clouds and Cloud-Like Regions at 1 AU: Occurance Rate and Other Properties”, Submitted to Ann. Geophysicae, in review

Magnetic Cloud Results



Cloud Radius

0.086 AU

0.089 AU

Field Magnitude

16.41 nT

16.69 nT

Asymmetry Factor

23.96%

24.02%

Future Plans

- Release of analysis software to use after data has been discovered and downloaded
- Currently adding more services, CoSEC applications and data sets

- More information and web interface:

http://vho.nasa.gov